

A RESUME OF THE GENUS CLEOBULIA (LEGUMINOSAE)
AND ITS RELATION TO THE GENUS DIOCLEA

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Cleobulia Mart. ex Bentham is a genus of papilionaceous legumes. The genus contains three species and falls easily into the Subtribe Diocleinae as diagnosed by Lackey (1977). Cleobulia is closely related to Dioclea H.B.K. This relationship has never been questioned. Cleobulia was placed in the Tribe Phaseoleae, Subtribe Diocleae, next to Dioclea by Bentham (1839, 1859, 1865). Taubert (1895) followed Bentham's side-by-side but separate relationship.

Macbride (1943) placed Cleobulia in synonymy under Dioclea. Hutchinson (1964) maintained Cleobulia as distinct from Dioclea as do Lackey (1977) and I (1969). The characters forming the basis of this relationship and my reasons for maintaining separate status are discussed below.

In Bentham's (1839) original description of Cleobulia, he described its close relationship to Dioclea based on his analysis of the similar habits, and floral and vegetative characters of the two genera. The fruits of Cleobulia were incompletely known. Bentham refused to unite the genera primarily because of the distinct wing petals of Cleobulia.

Cleobulia multiflora Mart. ex Bentham is the type of the genus. Bentham (1839) cited Martius's syntypes and specimens in Pohl's collections. Of these elements I have seen Martius s.n. (BR, M) and Pohl ? s.n. (W). The Pohl ? s.n. collection is a good, representative specimen determined "Cleobulia multiflora Benth. (tipse)," in what appears to be Bentham's handwriting; but the question mark after "Pohl" indicates doubt as to whether the specimen is actually a Pohl collection. Bentham did not cite any Pohl collections of C. multiflora in Flora Brasiliensis.

The Martius collections from M consist of three sheets tagged 12757, 12758, and 12759 (annotated by me 12 Aug., 1971). The sheet tagged 12757 is determined Cleobulia (& Cratylia) multiflora Mart. vid. Bentham; it contains the exact habitat and locality data Bentham used in his original description. The photo of Schott s.n., Brasilia, taken at K and cited below should be disregarded as an element if a lectotype for C. multiflora is chosen.

Bentham added the final two species, C. leiantha and C. diocleoides, in Martius, Flora Brasiliensis. He noted that fruits of C. multiflora and C. leiantha have a thickened upper suture and seeds with linear hila encircling about half the circumference of each seed; fruits of C. diocleoides have not been found. Bentham stated that all the Cleobulia characters are similar to Dioclea except for the dwarf wings scarcely surmounting the calyx and the shorter calyx teeth. He asked the question, "An melius pro sectione Diocleae habendi?" (Bentham 1859, p. 167).

It is interesting to note that Bentham listed, "Species 1, Brasiliensis. Benth. in Mart. Fl. Bras. Papil. 167. t. 45." in Genera Plantarum in 1865 even though he described the two new species mentioned above in Flora Brasiliensis before 1859, bringing the species total to three. I am not sure the omission was intentional. The page number and plate refer to C. multiflora. I have not found in the literature where Bentham might have reduced C. leiantha and C. diocleoides to varieties or placed them in synonymy although I have considered reducing C. leiantha myself.

Following the description of Cleobulia in Genera Plantarum, Bentham again stated that the genus is distinguished with difficulty from Dioclea Section Eudioclea, except for the dwarf wings and smaller flowers. Under Dioclea in Genera Plantarum, Bentham compared the three sections. He characterized Section Eudioclea species as possessing 1) stipules not produced from the base, 2) anthers uniform, and 3) the hilum linear, half encircling the seed. In my treatment of Dioclea (1969), I raised Bentham's sections to subgenera; these three characters still validly delimit taxa of Subgenus Dioclea.

Macbride (1943, p. 322) placed Cleobulia and

Cratylia in synonymy under Dioclea remarking, "The character or characters relied upon to distinguish Cratylia and Cleobulia are also found in varying degree of development in Dioclea and are not of taxonomic importance." Under Dioclea leiantha (Mart.) Macbr., comb. nov., he adds, "The genus Cleobulia, as remarked by Bentham and Hooker, was altogether artificial." I am unable to find where this strong a statement was made in the literature, but Bentham unquestionably felt Cleobulia was very closely related to Dioclea Section Dioclea.

The status of the genus Cratylia Mart. ex Benth. will be discussed in a subsequent paper (in prep).

It is interesting to note that Lackey (1977) reported all his examples of Diocleinae tested positive for canavanine except Cleobulia and one species of Dioclea, D. huberi Ducke. Dioclea huberi is anomalous within my Subgenus Platylobium (Benth.) Maxwell, stat. nov. ined. (which includes Sections Platylobium Benth. and Macrocarpon Amshoff) because of possessing a linear hilum; all other known seeds in the subgenus have oval or oblong hila. Dioclea huberi was the only species of about eight within the two sections that Lackey tested. The genus Cratylia (also of about eight species) if included in Dioclea would go into this subgenus, Section Macrocarpon, with D. huberi. Cratylia was also omitted from testing. Additional testing may show Dioclea as an artificial assemblage based on the canavanine character.

I feel the following characters are sufficient to maintain genus status for Cleobulia: the dwarf wing, about 2/3 the keel length and slightly exceeding the calyx; the short calyx lobes, about half the tube length; the flower length and the attitude of the standard (except reflexed in C. diocleoides). Other characters mentioned, such as the linear hilum half encircling the seed and non-produced stipules, are shared with at least one other genus; however, it is not uncommon for a single conservative character to delimit a genus in the Phaseoleae, such as the calyx lobe configuration in Canavalia.

CLEOBULIA Martius ex Bentham, Comm. Leg. Gen. 67.
1837.

Type: C. multiflora Mart. ex Benth.

Vines, twining and climbing, woody. Leaves trifoliolate, petiole and rachis canaliculate, the rachis reduced, occasionally absent; stipules triangulate, non-produced, persistent. Leaflets with the terminal lamina broadly ovate or obovate, the lateral broadly ovate or elliptic, inequilateral, reticulate above, sometimes rugose, pubescent above and below, the apices usually acute, the bases cuneate or rounded, with 6-8 pairs of primary lateral veins, prominent beneath; the stipels setaceous, ca. 1 mm long, persistent. Inflorescences usually axillary, occasionally with small leaves towards the base, erect, to 70 cm long, with flowers fasciculate-racemose along the distal 1/2-1/5 of the length; the tubercles sessile, globose; bracts triangulate, ca. 2 mm long, persistent or caducous. Flowers usually reddish, occasionally lilac or purple (color unknown in C. diocleoides), 10-15 mm to possibly 20 mm long, borne on short pedicels; bracteoles narrowly ovate or flabellate, ca. 3 mm long, usually caducous; bractlets caducous; the calyx campanulate, the tube ca. 6 mm long, ca. twice the lobe length, glabrous, glabrescent or with dense fulvous-ferruginous pubescence, 4-lobed, the upper lobe broadest, entire or shallowly bifid, the laterals and lower lobe acute, 2-3 mm long. Standard spreading or reflexed in C. diocleoides, with the lamina obovate-orbicular, shallowly emarginate, acallose, biauriculate plicate basally, puberulent adaxially towards the apex, the claw ca. 4 mm long; the wings free, ca. 2/3 the keel length, the lamina reduced, semisagittate, auriculate and usually with a spur, the claw ca. 4 mm long; keels with the lamina squarish, the upper margin auriculate basally, rising gradually along the upper margin then broadly truncate, gibbous, the claw 3-6 mm long, the wings and keels glabrous, the petals somewhat carnose; stamens 10, the anthers uniform, the vexillary filament free or attached submedianly to the staminal sheath, filaments of the other 9 fused basally forming a collar, then a tube, becoming free distally, the vexillary filament free basally, sometimes pubescent, the staminal sheath pubescent basally; the pistil straight, then geniculate, the style erect, ca. 3 mm long, glabrous, the stigma capitate, glabrous; the ovary ca. 6 mm long, 6-8

ovulate, sessile, velutinous. Fruits oblong, 2-valved, probably dehiscent, ca. 6 cm long, ca. 2 cm wide, 2-3 mm thick, the upper suture erect, with small ribs close or adnate to either side, the lower margin slightly swollen, naviculate. Seeds ca. 6, reniform, the hilum encircling nearly half the testa.

Key to the Species

1. Calyx glabrous or glabrescent, if glabrescent, sparse puberulent, the appressed hairs much less than 0.5 mm long; inflorescences lax, not appearing as a compact mass of flowers, the tubercles of the rachis distant.
 2. Standard reflexed (fide Bentham); upper leaflet lamina rugose; calyx glabrous, dark; flowers usually longer than 15 mm long, color unknown; bracteoles persistent?, keel petals more than twice the calyx length (fide Bentham); Southeastern Brazil: Minas Gerais.
 1. C. diocleoides
 2. Standard spreading; upper leaflet lamina not rugose; calyx glabrous, usually glabrescent, carneous; flowers to ca. 15 mm long, crimson; bracteoles caducous, keel petals nearly twice the calyx length; Amazonian Flora, Para.
 2. C. leiantha
1. Calyx velutinous, with fulvous-ferruginous hairs, the hairs erect or ascending, more than 0.5 mm long; inflorescences dense, appearing as a compact mass of flowers, the tubercles of the rachis crowded; Southeastern Brazil: Bahia, Espirito Santo, Minas Gerais, Parana, Rio de Janeiro,
 3. C. multiflora

1. CLEOBULIA DIOCLEOIDES Bentham in Martius, Fl. Bras. 15(1):168. 1859.

(P,holotype. Brazil: Minas Gerais, Saint-Hilaire 1311.)

Leaflets broadly ovate, the terminal sometimes obovate, the lamina 10-14 cm long, 7.5 - 12.5 cm wide, rugose above, whitish tomentose below, the apices obtuse or with acute tips. Inflorescences ca. 30 cm long, floriate about half the length, tomentose with ferruginous-fulvous hairs; tubercles of the rachis 0.5 - 1.0 cm apart, each few-flowered.

Flowers nodding, probably to ca. 2 cm long, borne on pedicels ca. 3 mm long or longer; bracteoles narrowly flabellate, 1-1.5 x 1-1.5 mm, glabrous, apparently persistent; the calyx moderately thick, broadly campanulate, the tube ca. 6 mm long, glabrous, the upper lobe very broad, the lowest ovate, the lobes less than half the tube length. Standard strongly reflexed, broadly orbiculate, probably ca. 18 mm long; wings with the lamina reduced, narrowly obovate, ca. 4 mm long, ca. 1.7 mm wide, the claw 3 mm long, auriculate and with a blunt, basal spur; keels slightly shorter than the standard, more than twice as long as the calyx, the lamina ca. 12 mm long, the lower margin rising distally, then strongly incurved; the vexillary stamen filament fused with the sheath towards the base, the staminal sheath collar and the enclosed vexillary filament clothed with white pubescence; the pistil probably similar to C. leiantha, with the geniculation of the style more strongly incurved. Fruits unknown, probably similar to the genus.

BRAZIL. MINAS GERAIS; Without exact locality, Saint-Hilaire Catal. B¹ N^o 1311 (P, holotype or isotype, F fragment of leaflet, ex P).

This description is based on Bentham's (1859) and the specimens cited. I differ from Bentham in the opinion that the inflorescences and floral parts of C. diocleoides are more similar to C. leiantha than to C. multiflora.

The P specimens were seen at US in 1970 through the kind auspices of Dr. V.E. Rudd.

In spite of the reflexed standard, the stronger incurved tendency of the keel and style, and the possible persistence of the bracteoles, I feel that the length of the calyx lobes relative to the tube length and the distinctive wings indicate a placement in Cleobulia rather than Dioclea. I would consider a different placement if mature C. diocleoides fruits and seeds are found which differ significantly from those of C. leiantha and C. multiflora.

2. CLEOBULIA LEIANTHA Bentham in Martius, Fl. Bras. 15(1):168. 1859.

(B from photo F Neg# 2402, BM, G, M, W, isotypes or syntypes, Spruce s.n. Aug. 1850; K from photo NYBG NS# 2488, isotype or syntype, Spruce 1003. Brazil: Pará, near Santarém.)

Cleobulia multiflora Mart. ex Bentham var. leiantha (Benth.) Maxwell stat. nov., ined.

Stems woody, the older reddish, with shredding bark, flat, angular, glabrescent or with a few short hairs, the young stems squarish, ferruginous-fulvous tomentose, with the hairs ca. 0.5 mm long; stipules 1.5 - 3.5 mm long. Leaves with the petioles to ca. 15 cm long, the rachis from 7 mm long to absent, the pubescence similar to young stems. Leaflets with the terminal lamina obovate, elliptic, to ca. 15 cm long, 7.5 - 10.5 cm wide, the laterals with lamina to ca. 13 cm long, 6.8 - 9.5 cm wide, inequilateral; the upper surface with erect, short, fulvous-ferruginous hairs, densely pubescent on the midrib and primary lateral veins, the lower surface and its prominent veins and veinlets with longer, curved, canescent-fulvous hairs. Inflorescences to over 70 cm long, florate half or greater the length, with short, canescent to ferruginous pubescence; tubercles of the rachis 0.5 - 1.5 cm apart, each 3-6-flowered; bracts acute-triangular, ca. 2 mm long, ca. 1 mm wide, in erect tufts at the apex of the inflorescences, ferruginous, caducous. Flowers with buds elliptic, with appressed, puberulent, ferruginous hairs, the flowers 12-15 mm long, borne on pedicels 1.5 - 2.0 mm long; bracteoles triangular-subtriangular, ca. 1 x 1 mm, caducous; bractlets similar to the bracteoles except smaller; calyx with the tube ca. 6 mm long, carneous outside, glabrescent, sericeous inside the tube and extending up the lobes, the lobes short, ca. half the tube length or less, the upper bifid or entire. Standard spreading, crimson, the lamina obovate-orbicular, ca. 10 mm long, 9-13 mm wide, the claw ca. 4 mm long; wings with the lamina semisagittate, ca. 4 mm long, ca. 3.5 mm wide, the claw ca. 4 mm long; the keels with the lamina squarish, ca. 5 mm long, ca. 6 mm wide, the claw ca. 5 mm long; stamens with the vexillary filament free or united, pubescent basally, sometimes glabrous, collar of the staminal sheath with white pubescence; the pistil with 90°⁰ geniculation, the ovary ca. 7 mm long, with fulvous-canescenscent hairs, ca. 0.5 mm long, ca. 7-ovulate. Fruits oblong, flat, to 7.5 cm long, ca. 2 cm wide, canescenscent-fulvous tomentose to glabrescent, the upper suture erect, with parallel ribs close to each side, the lower margin slightly swollen, the pedicel ca. 4 mm long. Seeds 5-7, somewhat reniform; the hilum linear, encircling nearly half the testa.

BRAZIL. PARÁ: Belterra, jungle edge, Baldwin 2773 (K as var. leiantha, US); Ducke RB#? 8351, 15-VIII-1907 (BM as var.); Igarapé da Lama, Planalto do Santarém, Froes 30893 (SP as var.); near Santarém, Ginzberger s.n., 13-VII-1927 (W as var.); Fordlandia, Tapajos R. region, Krukoff 1043 (G, NY as vars.); upper Cupary R., plateau between Xingu and Tapajos rs., Krukoff 1079 (BM, G, K as var., S, U); Rio Arapiuns, Lago Mentái, Pires & Silva 4362 (NY as var.); vic. Santarém, Silva & Souza 2232 (NY); vic. Santarém, Spruce s.n., Aug. 1850 (photos F, NY, US of type at B (F Neg# 2402), BM, F fragments ex B, G, M, W all types as vars.); Spruce 1003, Aug. 1850 (photos F, NY, US of type at K (NYBG, N.S. Neg# 2488)).

Cleobulia leiantha seems closer to C. diocleoides than to C. multiflora in having similar indument (or lack of) and, perhaps, similar flower size. However, C. leiantha, with a spreading rather than reflexed corolla and keel and stigma not as strongly incurved, differs from C. diocleoides.

Cleobulia leiantha, an element of the Amazonian flora, grows in terra firme along the edges of forests, in secondary forests, and in virgin mate. Flowering is from the last of June through November.

Bentham (1859) reported the species was cultivated, perhaps as an ornamental because of the crimson flowers.

3. CLEOBULIA MULTIFLORA Martius ex Bentham, Comm. Leg. Gen. 67. 1837 and Ann. Mus. Wien 2:131. 1839.

(M syntypes, based on sheets tagged 12757, 12758, 12759. Brazil: probably Minas Gerais, Martius s.n.) Illustrated in Martius, Fl. Bras. t. 45.

Dolichos coccineus Velloso, Fl. Flum. 321. 1825, Icon. 7, t. 158, 1835. inc. sed.

Cratylia multiflora Benth. nom. nud. (MSS name on Martius s.n. at M)

Stems to 2.5 m long, terete, canescent-fulvous tomentose; stipules ca. 1 mm long, pubescent. Leaves with the petioles deeply canaliculate, almost winged, 5-10 cm long, the rachis from 10 mm long to almost absent, the pubescence similar to young stems. Leaflets with the terminal lamina obovate, elliptic or

orbicular, 9-14 cm long, 6.5 - 10.0 cm wide, the laterals with lamina ovate to oval, greatly inequilateral, to ca. 13 cm long, to ca. 10 cm wide, the upper surface pubescent with erect to ascending curved ferruginous hairs, the lower surface with ascending canescent-fulvous to ferruginous hairs from the prominent veins and veinlets. Inflorescences 30-55 cm long, occasionally branching, florate $1/5 - 1/3$ the length, rarely half the length, canescent-fulvous tomentose; tubercles crowded distally, each ca. 6-flowered; bracts triangulate, ca. 3 mm long, fulvous pubescent, persistent. Flowers with buds globose to slightly elongate, densely covered with velutinous, ferruginous pubescence, the flowers 10-12 mm long, borne on pedicels ca. 2 mm long; bracteoles ferruginous, somewhat lanceolate, 2 mm long, less than 1 mm wide, caducous; calyx with the tube ca. 6 mm long, with appressed, ferruginous pubescence, sericeous inside the tube and up the lobes, the lobes short, ca. half or less the tube length, the upper lobe bifid or entire. Standard spreading, red, rose red, lilac to purple, the lamina obovate-orbicular, ca. 10 mm long, ca. 12 mm wide, the claw ca. 4 mm long; wings with the lamina semisagittate, ca. 3 mm long, ca. 2 mm wide, the claw ca. 4 mm long; the keels with the lamina squarish, ca. 5 mm long, ca. 4.5 - 6.0 mm wide, the claw ca. 5 mm long; stamens with the vexillary filament apparently free, densely pubescent towards the base and on the adjacent staminal sheath; the pistil with 90° geniculation, the ovary ca. 6 mm long, with ferruginous-fulvous hairs over 0.5 mm long, 6-9-ovulate. Fruits oblong to elliptic, coriaceous, flat, ca. 6 cm long, ca. 2 cm wide, ferruginous-fulvous velutinous, the upper suture thickened, the lower margin swollen. Seeds ca. 6, reniform; the hilum linear, encircling nearly half the testa.

BRAZIL: WITHOUT EXACT LOCALITY: Rio de Janeiro or São Paulo, Bowie & Cunningham s.n. (BM); Glaziou 8455? (C); São Paulo?, Krieger 1105 (SP); Martius? 605 (BR); Pohl? s.n. (W, annotated as syntype fide Bentham (1839)); Alcantarra?, Riedel 1319 (BM, GOET, LE, NY, US, W); Saint-Hilaire C279 (P); Schott s.n. (photo C, NY, US of "type" at K, NYBG, N.S. Neg# 2489, not a type); Schüeh s.n. (NY, W); Sello or Gardner 798 (BM); Talbot 984 (K); Minas Gerais?, Warming 3194 (C). BAHIA: Between Lencóis and Itaberaba, Pereira 2054 (BM). ESPIRITO SANTO: Forest reserve of Sooretama, Belém 1500 (UB). MINAS GERAIS: Fazenda de Cachoeira, Barreto 1501 (SP), 5796 (BHMG, US);

Santa Barbara, Barreto 5416 (BHM, SP); Bento Rodrigues, Damazio 1886 (G); Ponte Nova, Diogenes BHM or MG # 22.456 (BHM, MG); near Pachero, Exp. Stat. of Cofe, Heringer 559 (SP); Road to Rio Novo, Heringer 1030 (SP); Barra do Rio Piranha, Martius s.n. (M) syntypes, 3 sheets tagged 12757, 12758, 12759); Viosa, road to São Miquel, Mexia 4566 (BM, G, S, US), 4763 (BM, G, S, U, UC, US); Teófilo Ottoni, Trinta 748 & Fromm 1824 (NY); 18 km N of Sêro, L.O. Williams 6803 (UC, US); without exact locality: Ackermann s.n., 1832 (BR); Martius s.n., 1832? (BR); Miers s.n. (BM); Saint-Hilaire B⁺ 704 (P); Sello s.n., 98, 284 (BM). PARANA: Barra Grande, Mun. Bocaiuva do Sul, Hatschbach 7133 (US). RIO DE JANEIRO: Between Rio de Janeiro and the Orgãos Mts., Gardner 353 (BM, G, W); Restinga de Mauá, Hemmdroff 421 (S); Cantagallo, Martius s.n. (BR), Martius? 280 (BR); Guanabara, Ilho do Governador, Pabst 4515 (M, NY); near Sumidouro, F.J. Pabst et al 5386 (NY); Baixada, G. Pabst 7362 (NY); Cantagallo, Peckolt s.n. (BR, W), 68 (W), 264 (W); Capivari, Mun. de Caxias, Pereira et al 4185 (NY); Mandiocca, Riedel s.n. (K, LE, NY), 677 (LE); Barra de Sao João, Iriri Beach, Segadas-Vianna et al 387 (US); between Rio Bonito and Casimiro de Abreu, Trinta 928 & Fromm 2004 (NY); without exact locality: Allemão s.n., 1860 (G); Casaretto 1516 (G); Gardner 5433 (BM); Glaziou 2540 (BR, C); Minas Gerais or Rio de Janeiro, Raben 605 (BR); Herb. Warming 3112, tag on stem 362, Warming 3112 (C). SÃO PAULO: Igaratá, Kuehn & Kuhlmann 1958 (SP); S. José dos Campos, Lofgren 304 (S), 3692 (U, US), 3693 (S); Guaratinguetá, Porto RB # 6995, 15-6-1916 (U); Santa Izabel, Kuhlmann SP# 35812, 15 VIII 1936, (SP); without exact locality: Riedel & Langsdorff 735 (LE); Saint-Hilaire Cat. D 780 (P).

The Allemão s.n. (G) specimen cited above had been determined Dolichos coccineus Velloso. I examined the Velloso plate (1835) at the Missouri Botanical Garden. The text description I referred to is from Arch. Mus. Nac. Rio de Janeiro 5:301, 1881. Sampaio and Peckolt (1943) do not comment on the nomenclature of D. coccineus.

The plate shows clearly the short calyx lobes which characterize Camptosema p.p., Cratylia p.p., and Cleobulia. These genera have sympatric species in Rio de Janeiro, where Velloso collected.

Dolichos coccineus, as described in the text and

shown in the plate, is similar to Cleobulia in the following characters: habit; glabrous (except multiflora); inflorescences erect, congested, bearing spikes (tubercles); flowers short (except diocleoides?), flower color, short calyx lobes; standard spreading (except diocleoides), sub-rounded, wings shorter than the keel petals; somewhat similar pistil geniculation; habitat and distribution (of multiflora); flowering in November.

However, as noted, there are exceptions to the similarities. Also, the leaflet shape in the plate is not similar to that of Cleobulia.

The leaflet shape in the plate is similar to Cratylia species; but these species also possess reflexed standards, large wing petals about equal to or longer than the keels, and pubescence.

The description and plate also share several characteristics with Camptosema species; but these species usually have long flowers, with the laminae of the petals long and narrow, the wing and keel lengths about equal, and the petals membranous.

The text description is too brief, and diagnostic characters are omitted. The corresponding plate shows neither gynoeceal nor androeceal characters clearly, and the fruits and seeds are unknown. The same conditions hold with other Velloso names. I call attention to this fact because many Subtribe Diocleinae species can be found here.

Although the description and plate of D. coccineus show many similarities to Cleobulia multiflora, I cannot justify any placement on the basis of my current knowledge of the related genera. I would not advocate the insertion of Velloso's names based on the descriptions and plates without a high degree of certainty because of the nomenclatural changes and ramifications that would probably follow.

Besides differing from C. leiantha in distribution, C. multiflora can also be distinguished by its densely packed flowers on a shorter rachis, the more pubescent indument aspect (on buds, calyx, peduncle rachis, perhaps standard, and leaves), persistent bracts, a pubescent vexillary filament towards the base, flower color other than shades of red (towards purple and lilac), and the usual presence of a

distinguishable leaf rachis. The lower latitude C. multiflora begins flowering the last of March almost three months earlier than C. leiantha. Both finish flowering in November. Regardless of these differences, the aspects of C. multiflora and C. leiantha are so similar there is no question of realigning one without the other, as might be the case with C. diocleoides and either of the other two.

Bentham (1859) used the lack of a leaf rachis (so that the leaflet petiolules are all inserted at the same point), the calyx tube glabrous or puberulent outside and thinly sericeous inside, and the smaller wings and keel petals of C. leiantha to separate it from C. multiflora. Analysis of the additional specimens cited, however, shows C. leiantha commonly has a discernible leaf rachis, as in Silva & Souza 2232 (NY); C. multiflora has a rachis length from about 1.5 cm to apparently absent (the rachis is absent on only one leaf of Hatschbach 7133 (US)). My dissections show the lengths of the wings and keel petals of the two species are about the same with those of C. leiantha perhaps a little longer. The characters (except pubescence) Bentham used to distinguish the two species had previously led me to conclude that the two taxa might have a varietal rather than specific relationship. Moving the three Cleobulia taxa into Dioclea Section Dioclea, with pubescence as a character of sufficient magnitude to delimit species within Section Dioclea, is simply untenable.

Table 1 compares selected characters between the pertinent taxa. A "+" indicates character present; a "-" indicates character lacking; a "+" indicates character present in some species but not others.

Figure 1 illustrates some of the major characters. A, Cleobulia leiantha, flower aspect (Silva & Souza 2232 (NY)); B, C. diocleoides, keel and wing (Saint-Hilaire 1311 (P)); C, C. leiantha, standard, keel and wing (Silva & Souza 2232 (NY)); D, C. multiflora standard, keel and wing (Porto RB # 6995 (U)); E, C. multiflora, vexillary stamen (Diogenes BHMG # 22.456 (BHMG)); F, C. leiantha, disc region and androecium (Silva & Souza 2232 (NY)); G, C. leiantha vexillary stamen and gynoeceium (Silva & Souza 2232 (NY)).

Table 1

A summary of the Diagnostic Characters of Cleobulia and their Relation to Dioclea Section Dioclea and Dioclea Other Sections.

| | <u>Cleo- bulia</u> | <u>Dioclea</u> Sec. <u>Dio.</u> | <u>Dioclea</u> Oth. Sec. |
|--|------------------------|------------------------------------|-----------------------------|
| dwarf wings | + | - | - |
| short calyx lobes | + | - | - |
| reddish flowers | ± | - | - |
| spreading standard | ± | ± | - |
| fruits without distinct ribs or ribs adnate or close to the upper suture | + | - | ± |
| reduced leaf rachis | ± | ± | - |
| stipules non-produced | + | + | - |
| flowers small | + | ± | ± |
| pubescence on some petals | + | + | ± |
| uniform anthers | + | + | ± |
| vexillary stamen filament fused to others | ± | + | + |
| vexillary stamen filament pubescent and/or surrounding staminal sheath | ± | - | ± |
| pistil geniculation configuration | + | ± | ± |
| seeds 6 to ca. 8 | + | ± | ± |
| seed hilum nearly $\frac{1}{2}$ encircling | + | + | ± |
| distribution | + | ± | ± |
| habit, including inflorescence aspect | + | + | + |
| habitat | + | + | ± |

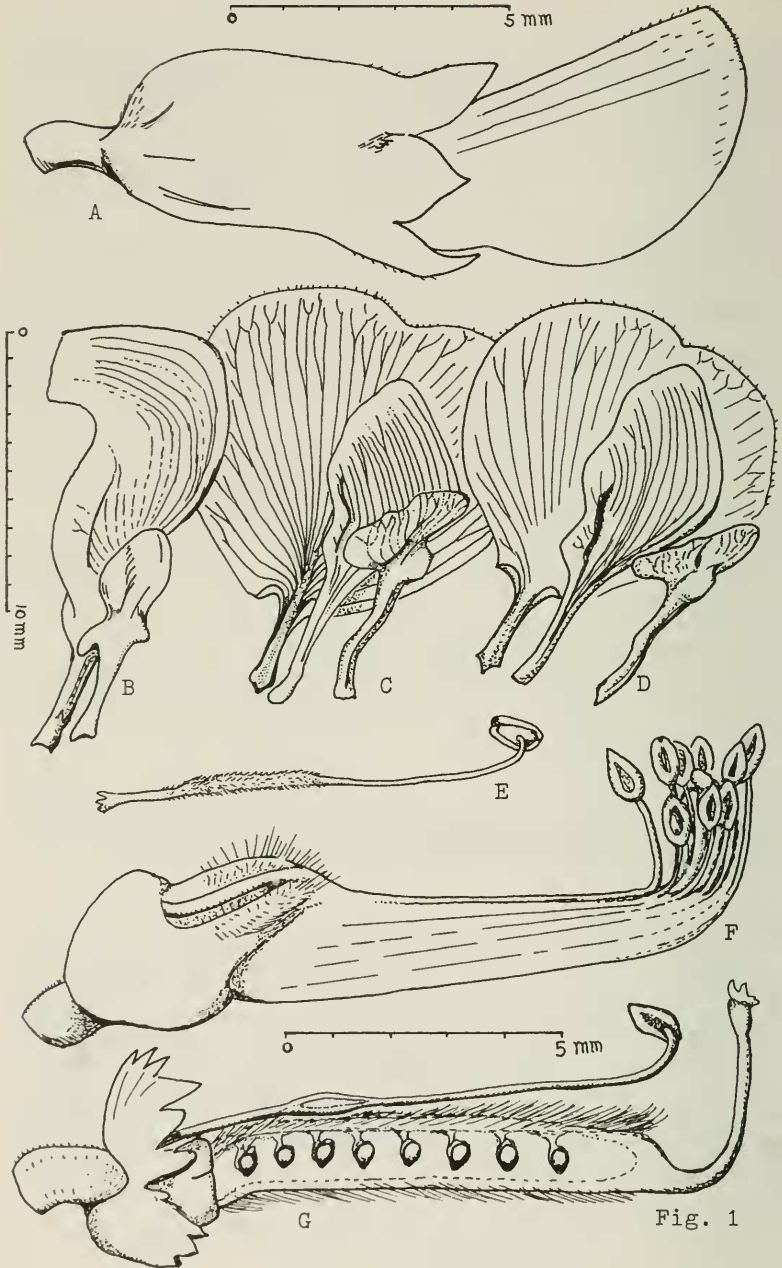


Fig. 1

In conclusion, I feel that Macbride's justification for combining Cleobulia with Dioclea is not sound. I maintain Cleobulia as closely related to, but separate from Dioclea. I follow Bentham in giving the wing character heaviest weight and then the calyx lobe length to calyx tube length ratio in delimiting the genera. Cleobulia leiantha and C. multiflora are more similar to each other than to C. diocleoides. The generic placement of C. diocleoides is provisional because of the lack of collection material.

REFERENCES CITED

- Bentham, G. 1839. Commentationes de Leguminosarum Generibus. Ann. Mus. Wien 2:131. (Preprint 1837)
- 1859. Leguminosae. Papilionaceae. In Martius, Flora Brasiliensis. 15(1):1-350.
- 1865. Leguminosae. In Bentham, G. and Hooker, J.D., Genera Plantarum. 1(2):434-600. London: Reeve & Co.
- Hutchinson, J. 1964. Genera of Flowering Plants. 1. London: Oxford University Press.
- Lackey, J.A. 1977. A Revised Classification of the Tribe Phaseoleae (Leguminosae: Papilionoideae), and Its Relation to Canavanine Distribution. Bot. Journ. Linn. Soc. 74:163-178.
- Macbride, F. 1943. Flora of Peru. Pub. Field. Mus. Nat. Hist. Chicago, Bot. Ser. 13. 3:322-326.
- Maxwell, R.H. 1969. The Genus Dioclea (Fabaceae) in the New World. Ph.D. Thesis, Southern Illinois University at Carbondale.
- Sampaio, A.J. and Peckolt O. 1943. A nomenclatura das especies na "Flora Fluminensis" de Conceicao Veloso e sua correspondencia atual. Arq. Mus. Nac. Rio de Janeiro 37:331-394.
- Taubert, P. 1895. Leguminosae. In Engler, A. and Prantl, K. (Eds.) Die Naturlichen Pflanzenfamilien. 3(5):369-416. Leipzig: William Englemann.
- Velloso, J. 1825. Florae Fluminensis. Reprint in Arch. Mus. Nat. Rio de Janeiro 5 (1881).
- Velloso, J. 1835. Florae Fluminensis-Icones, 7 t. 158.